Space Weather Technical Forecast

Issued on Friday, 27 January 2023 at 01:10 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Decreasing chance of R1/R2 Radio Blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate over the past 24 hours with a M2.84 flare observed at 26/1306 UTC from AR3192, which has now rotated behind the west limb. This leaves seven numbered sunspot regions on the visible disc. However, all regions are small, weak and magnetically simple, and either stable or showing slight decay. No Earth-directed CMEs were detected in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind gradually increased from initial slightly elevated levels around 450 km/s, to end the period at elevated levels near 550 km/s, with a peak of 568 km/s at 26/1850 UTC. Density was average or slightly above. The total IMF, Bt, was Weak to Moderate, occasionally reaching 9nT. The north-south component, Bz, was weak, reaching -6nT in the southward direction. The phi angle was mainly positive, (away from the Sun), with a brief fluctuation to become negative (towards the Sun) in the evening. Geomagnetic Activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has been at Background levels throughout. High energy electron flux (greater than 2 MeV) has been at Background to Moderate. The associated 24-hour integrated electron fluence stayed well below the Active threshold, with a decreasing trend, and 6.21 e6 integrated pfu was observed at 27/0001 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be predominantly Low as active regions (3190 and 3192) have now rotated onto the far side. These regions will continue to give a residual risk of M-class flares through today, but thereafter the chance of M-class flares rapidly decreases as the remaining seven regions on the visible disc are all small, weak and magnetically simple.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs in this forecast. Solar winds are currently elevated due to the arrival of the fast winds of CH69/+. Little change is expected today and much of tomorrow, as tomorrow there is a chance of a further weak enhancement in the solar wind from CH71/+. Then from day 3 (29th) the solar wind is expected to decline to slightly elevated levels. Geomagnetic activity is expected to be Quiet with Unsettled (Kp 1-3) for much of the period, but with a chance of isolated Active (Kp 4) intervals and a slight chance of G1/Minor Storms (Kp 5) today and tomorrow.

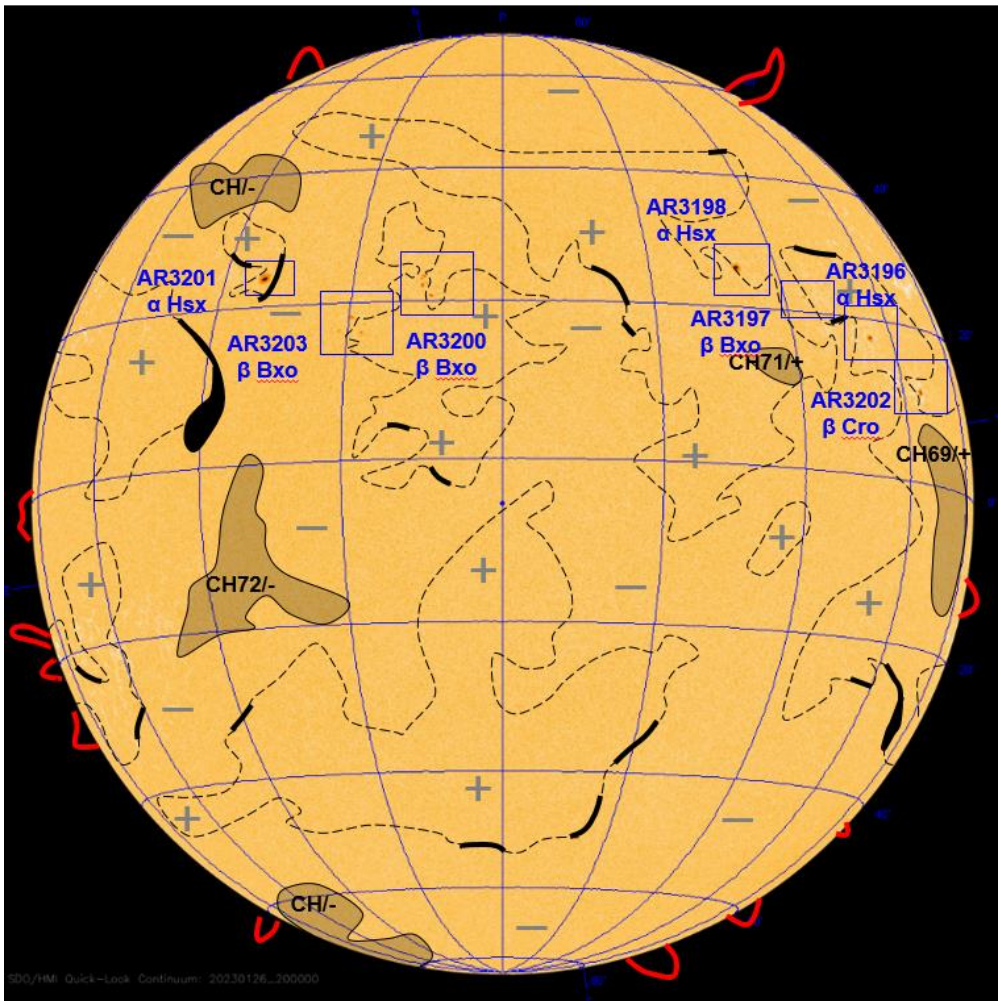
Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES16 is likely to remain at predominantly Background levels. However, there is a slight chance of reaching the S1 Solar Radiation Storm level through today, due to the residual risk AR3190 and AR3192 which have now rotated onto the far side.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Electron flux will start at Normal Background to Moderate levels, but are likely to increase later in the period response to the current high speed stream from CH69 and potentially a further slight enhancement from CH71. However, despite the expected rising trend through the period, the fluence is likely to remain below the Active threshold (1e8 integrated flux) as the starting levels are so low. Therefore only a slight chance of Active fluence is expected, mainly from day 3 (29th).

Figure 1. Solar Analysis Valid 26/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

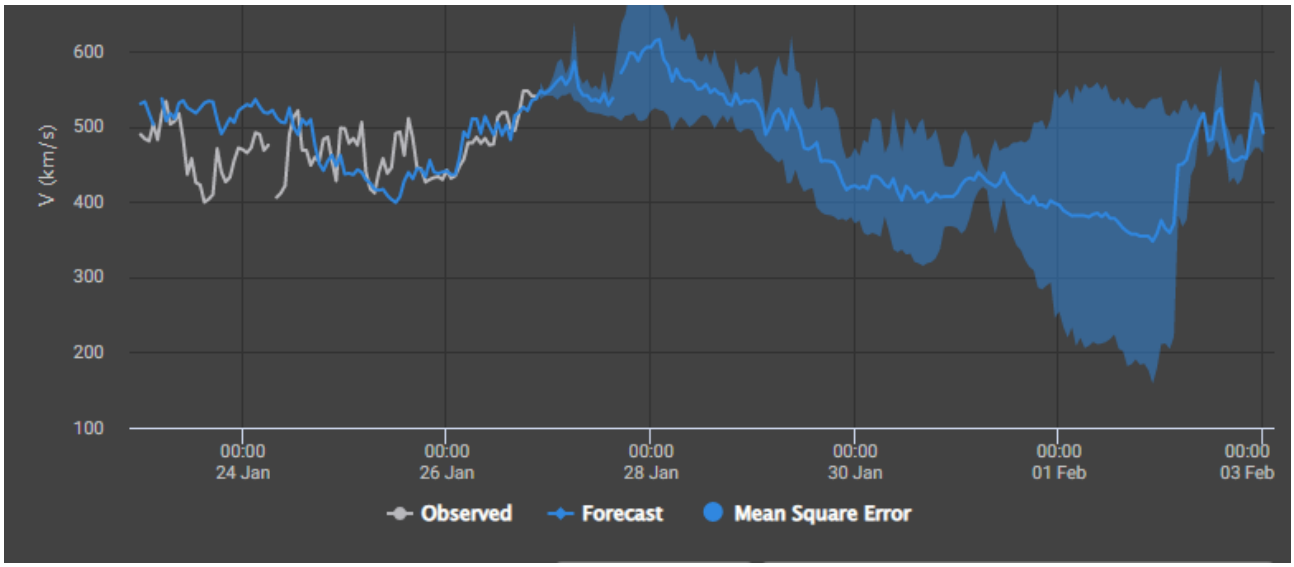
Geomagnetic Storms:

The forecast period currently features no Earth-directed CMEs.
Earth is currently under the influence of a high speed stream (HSS) from CH69. A further slight enhancement may occur tomorrow, due to a weak HSS from CH71, which is a small and barely discernible feature. Therefore today and tomorrow mainly elevated solar wind speeds are expected, with a decline to slightly elevated speeds from day 3 (29th). However, looking at persistence from the previous rotation, there is a chance of the solar wind briefly reaching strong levels today or tomorrow.

Geomagnetic activity is expected to be Quiet with Unsettled (Kp 1-3) for much of the period, but with a chance of isolated Active (Kp 4) intervals and a slight chance of G1/Minor Storms (Kp 5) today and tomorrow.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	10	20	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Solar wind persistence.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Met Office Space Weather Technical Forecast

Radio Blackouts - X-Ray Flares:

Activity levels are expected to quickly decrease as the sources of the recent Moderate activity, AR3190 and AR3192, will continue rotating further across the far side of the Sun. The current remaining seven regions are all small, weak and magnetically simple. However, far-sided products indicate that active regions may rotate onto the visible disc within the next few days, with a bright area on STEREO-A EUVI in the south, showing the likely return of ex-AR3181. Overall, activity is likely to be predominantly Low, but with a chance of M-class flares today and then a slight chance of M-class flares thereafter.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	30	10	1	1
Very Active	R3 to R5 X Class	No	5	1	1	1

Solar Radiation Storms - (High Energy Protons):

High energy (greater than 10MeV) protons as observed by GOES-16 are currently forecast to persist at background levels, but with a slight chance of rising in response to any significant flaring, and perhaps approaching the S1 level.

This is most likely to come from AR3190, which has now rotated onto the far-side. Despite this, any notable flaring from this region will continue to bring a potential for increased proton flux through today. Despite the large number of other active regions on the disc, these are all smaller and simpler, with a lower risk of proton rich flaring.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

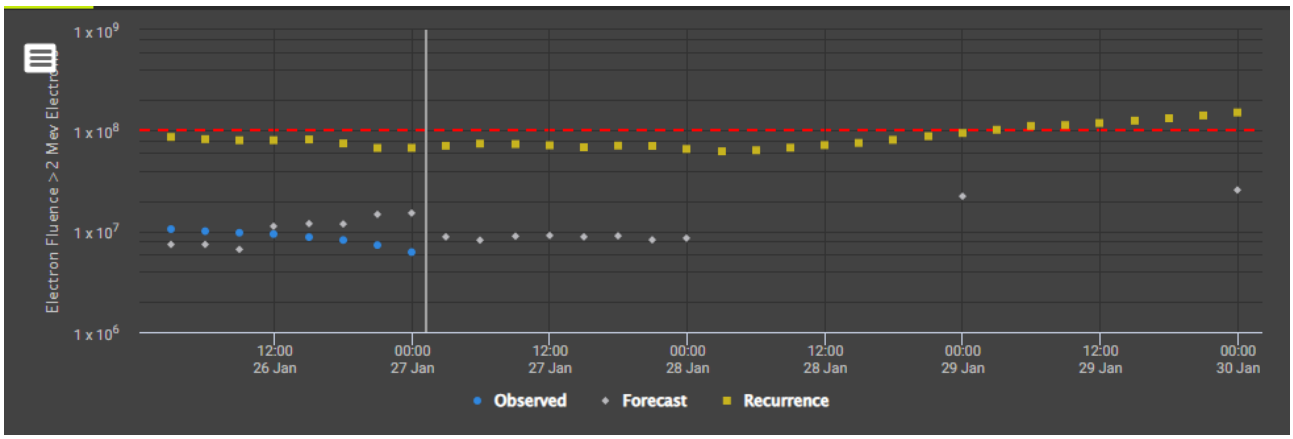
© Crown Copyright 2023. All Rights Reserved.

High energy electron flux (greater than 2 MeV) will start at Normal Background to Moderate levels, but are likely to increase to predominantly Moderate levels later in the period response to the current high speed stream from CH69, and potentially a further slight enhancement from CH71 tomorrow.

The associated 24 hour fluence is forecast to stay below the Active (1e8 integrated flux) threshold throughout, but with an increasing although trend. This is supported by REFM which indicates a gradual rising trend, well below the Active threshold.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	10	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: Met Office REFM model.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.